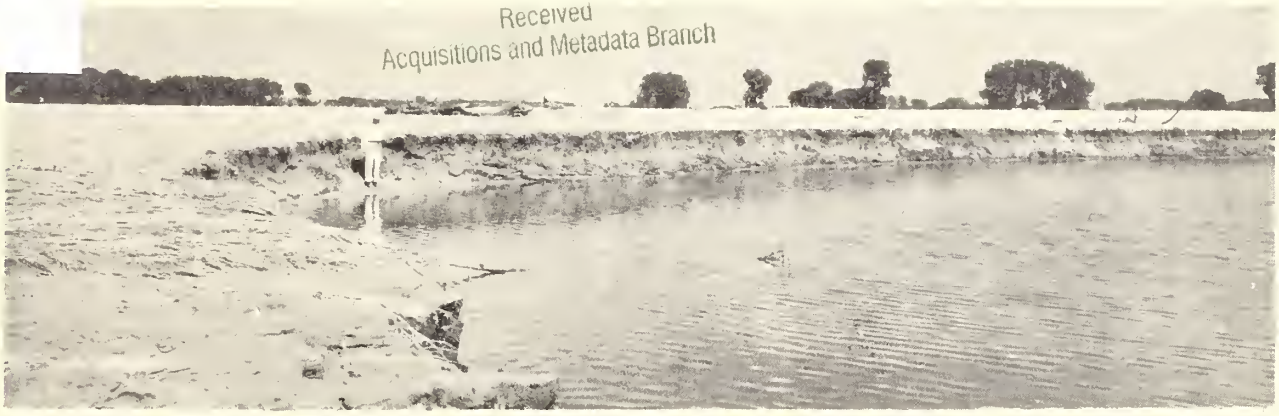

Here the swollen Kaw took a vicious bite out of the rich farm land of Fred Grobe, in Douglas County.

THE COMPLETE WATERSHED PROGRAM IN FLOOD CONTROL

By HUGH BENNETT
Chief, Soil Conservation Service

IT IS a real inspiration to me as a soil conservationist to meet with you newspaper editors assembled here in Lincoln to consider the critical problem of flood control. It is a significant milestone, I think, in the Nation's march toward preserving its basic soil and water resources, when several hundred busy editors come together on their own initiative and at their own expense to discuss ways of achieving sound and effective flood control in this breadbasket of the Nation.

The recent flood catastrophe in Kansas and neighboring States has once more focused attention on the urgent need for doing the best we know how to prevent the recurrence of disastrous floods which every year somewhere in this area, as well as in other parts of this country, tear down with great destructiveness across productive farm land and through prosperous towns and cities. The effects of floods are very real to you people right here in Lincoln and throughout southeastern Nebraska after your experiences of May and June last year, and again this year.

What can be done—what must be done—to prevent the staggering losses in crops, in property, and even human life depends in large degree on the determination and efforts of you people who are in this audience today.

Some among you may feel that we cannot afford the cost of flood control in these times of national emergency. As a civil servant, I did not come here to tell you what the Nation's policy should be in this regard. That is for you, the people, to say. But there are some things I can tell you.

First, the rivers out here did not wait until we had settled our score with the Communists before they decided to go on a rampage. We hope that neither we nor our children will live to see another

Once a comfortable farm home, now a shambles. The author sadly ponders the wreckage and the greater tragedy of which it is a part.

Note.—Dr. Bennett delivered this address at the Newspaper Editors' Flood Control Meeting, Lincoln, Nebr., August 11, 1951.

catastrophe like this last flood. But, unfortunately, we can be certain that, emergency or no emergency, costly floods in all probability will strike again next year, and the next—somewhere in Nebraska, Iowa, Kansas, Missouri, or other parts of the Nation.

Secondly, I can tell you that it is possible to control these floods. It is possible to eliminate almost completely the smaller and more localized floods, and it is practicable also to reduce greatly the damages from tremendous rainstorms that cause super floods like this last one.

No single method of flood control, however, will do the whole job. We have seen in this great flood, for example, how levees high enough to have withstood the largest previous floods of record were overtopped. On the other hand, we have also seen how the soils of our fields and pasture lands became so saturated with water after 2 months of heavy rains that they could absorb very little more from the final big rain. No, to meet all kinds of flood conditions, and to prevent or minimize flood damages wherever they occur, we must use every available method of control that we know about.

We must develop a sound, coordinated plan for every watershed to assure a properly balanced and truly effective attack directed toward prevention of flood damages. The day of piecemeal flood control—where only a part of the damage in a watershed is considered—is rapidly drawing to a close.

Our efforts to control floods must begin where the rain strikes the ground. Every additional gallon of water that we can get into the soil by improving its intake capacity with conservation measures means 1 gallon less contributed to the flood flow. Let no one mislead you into believing that it is ever impossible to get more of the rain into the soil. No matter how much rain has already fallen, we have yet to find a soil on sloping land that does not have some water-holding capacity left. In other words, a soil is never completely saturated unless it is below the ground-water table, as in a swamp. Water will still go in along roots, and will penetrate through cracks in the ice of so-called "frozen soil." It is true that when the soil is comparatively dry it can take up many times as much water as it can after prolonged rains. But it is also a mathematical certainty that the soil can always take up some more water. Therefore, our first step in flood prevention, under all conditions, is to put the soil, as far as practicable, in a condition conducive to optimum water intake.

What excess water does run off the fields into the drainageways, we must slow down with small retarding structures and with other improvements in the watercourses. And what flows out of the creeks we will have to handle in the main river valleys by more imposing measures—engineering measures such as reservoirs and levees.

Our job of flood control, then, begins where the raindrop falls and it does not end until the water reaches the ocean.

The important problem now confronting all of us is to determine, in cooperation with each other, what kinds and combinations of measures are needed, watershed by watershed, to accomplish the most effective flood control we can afford. In doing so we must, of course, bear in mind our continuing need for irrigation storage, for power production, for municipal water supply, for pollution abatement, for preserving fish and wildlife resources, and especially the need for maintaining maximum agricultural production on fertile valley lands. Our watershed plans must provide not only for the control of floodwaters, but also for their conservation for beneficial use. In this connection, let us bear in mind that the limited number of available sites for larger reservoirs should, wherever possible, be considered with respect to multiple land and water needs before they are dedicated solely to flood control.

There are several reasons why sound and enduring flood control, aimed to benefit all the people,

This city bus rode 500 yards down the raging Kaw, ending its journey in a mad chaos of water, mud, and debris.

This corncrib floated in from another county, and now stands sentinel on a sanded area that formerly was a leading corn-producer in Kansas.

can be achieved only through a coordinated attack. The first of these reasons is apparent from the distribution of flood damages. Although some engineers may dispute what I say—and might even quote Webster against me—I submit that flood damages begin where the rain falls, regardless of what Webster may have thought about it. The crops on upland farms that are swept down by storms which cause great floods are just as truly lost as the crops on overflowed land in the valleys below. The soil washed off upland fields reduces the productivity of the land just as much as does deposition of soil by the water flooding over agricultural bottom lands along the rivers. Floodwater damages to agricultural lands in thousands of miles of small creek bottoms throughout our watersheds represent just as much loss per acre as flooding of the wide Missouri River Valley between Kansas City and St. Louis.

The Soil Conservation Service has just completed a preliminary survey of the storm and flood damages in Kansas and Nebraska, during July. This is what we found: Losses of crops on upland farms amounted to approximately $110,000,000. Losses of irreplaceable topsoil, the thin and fertile layer that sustains agriculture in this granary of the Nation, has been estimated at $200,000,000. This figure is based on the differences we have found in crop yields with different depths of topsoil. Losses from floodwater and sediment in the creek bottoms and small stream valleys, above the points where anyone has yet proposed specific flood-protection measures, were estimated at $102,000,000. The total of these three figures is $412,000,000. Additional losses in Missouri, Oklahoma, Iowa, Illinois, and other neighboring States would bring the total probably to well over a half billion dollars in the one month of July.

Without in any way minimizing the staggering losses at Kansas City and along the major river valleys, we believe that these astounding damages along the tributaries are convincing evidence that a flood-control program aimed only at downstream cities and river bottoms is only a partial flood-control program and not one designed to benefit all the people who have suffered losses.

Let me give you another reason why this country needs a coordinated and complete flood-control program extending to every acre all the way down to the sea. To be sure, super floods like this last one are comparatively rare events. I am told that the flood discharge at Kansas City far exceeded the highest ever previously experienced, which was back in 1844. When an event exceeds all previous expectations and wreaks such havoc, it not only makes banner headlines, but it becomes an historic classic. It gets into our memories and textbooks. People come to look on it as characteristic rather than something rare—or unique. Actually, if one spreads the enormous damage caused by this flood over all the years between such rare events, the average annual loss is considerably less than the damages from all the smaller local floods that occur year after year in the smaller watersheds throughout Kansas, Nebraska, Missouri, Oklahoma, Iowa, and Illinois. A typical example of the smaller, more frequent floods has occurred here on Salt Creek these last 2 years. You local people are only too familiar with this kind of flood.

Our surveys show that 75 percent of our average annual flood loss has occurred above the main river valleys and large cities. This, of course, is due in no small measure to the fact that a substantial part of our major river flood plains and cities are already protected by levees and major reservoirs, for which credit is due primarily to the

effective work of the Army's Corps of Engineers.

I can give you still other reasons why a coordinated approach to flood control is essential. Soil erosion on watershed lands must be brought under control to protect downstream flood-control works. We must control erosion to protect our flood-control reservoirs from rapid silting and loss of effectiveness. We must control erosion to prevent the silting of stream channels, which further reduces their flood-containing capacity. We must control erosion, moreover, to prevent overwash of infertile sand and poor subsoil material on our productive bottom lands. But even more important than all of these, we must control soil erosion if we are to maintain the base for our agriculture, our national strength and defense, and, indeed, to prevent our civilization going the way of many great nations of the past which failed to take care of their agricultural land.

So that there may be no mistake about where we stand in the Soil Conservation Service, let me reaffirm:

1. That we believe, and our widely multiplied experience confirms, that flood control is a job which begins where the rains fall and the runoff starts—that is, in the fields and pastures and forests, and ends only when the runoff has safely reached the ocean.

2. That we believe wholeheartedly in coordinated planning and treatment of entire watersheds and drainage basins in cooperation with the Army Corps of Engineers, with soil conservation districts, with watershed associations, and with all other Federal, State, and local agencies that have a responsibility in land and water management.

3. That the work of the Soil Conservation Service is in the fields and pastures and wood lots and on the upstream tributaries of the major rivers. Our job is first to assist landowners and operators to use their land within its capability, and to treat it with sound conservation practices in accordance with its needs. Beyond this, our job is to assist organizations of local people to install upstream flood-prevention measures, such as small retarding structures, gully plugs, and channel improvements. If, through such a program, we can cause the water which falls on the lands in the upper watersheds, or even a considerable part of it, to delay its race to the sea, we have by that action won part of our objective—completed part of the job of flood control.

But this kind of program alone will not prevent flooding of the main river valleys and the cities in them.

I understand that some of your local papers have editorially attributed to soil conservationists claims to the effect that the amount of money spent on large flood-control reservoirs would, if spent in the watersheds, dry up the rivers. Well, I don't believe any employee of the Soil Conservation Service ever thinkingly made such a statement. If he did, I repudiate it here and now. In my opinion additional controls such as reservoirs, levees, and other main channel protective works will be needed to safeguard the flood plains of our major rivers against such disasters as we have just experienced. This trunk channel job is the responsibility of the Corps of Engineers, which has ably fulfilled its part of the job for more than a century.

4. We believe that coordination of the river-control and watershed programs was the intent of Congress when it passed the Flood Control Act of 1936. We believe it is still the intent of Congress. We do not believe that Congress intended one program to be in any sense a substitute for the other, but rather that they should be complementary parts of a single job.

The Flood Control Act of 1936 and subsequent acts provide all the authority needed by the Department of Agriculture and the Corps of Engineers to work together in planning and carrying out a complete program for alleviating flood damages and conserving soil and water resources. Such watershed and river-basin plans for flood control, as we see it, involve three principal types of operations, namely:

(1) *Land treatment.* Our conservation farm and ranch planning is based on the principle of treating every acre of land according to its need, and using each acre according to its capabilities (that is, for cultivated crops, grass, timber, or wildlife). It also includes safe and orderly disposal of runoff water originating on the farm or ranch. Land-treatment measures prevent erosion, maintain soil fertility, conserve water by storing it in the soil, prevent damage on the farm from the erosive action of rainfall and runoff, and reduce the sediment loads of creeks and rivers. Land-treatment measures are now being rapidly installed by landowners throughout this area—as well as other areas—under the programs of the locally organized soil conservation districts, aided by technical assistance

from the Soil Conservation Service and by other forms of assistance, such as educational and financial. We have ample authority for this part of the program, but funds available for technical assistance fall far short of the need, if we expect to achieve substantial flood protection in the next 10 or 15 years.

Highways were undermined and washed out, fences and power lines destroyed. In the background, here in Douglas County, a sheet of sand was deposited.

(2) *Upstream engineering* for water-flow retardation and channel stabilization. This phase of the watershed plan involves work on the tributaries and waterways to control or retard runoff from neighboring farms. These measures alleviate damage to the agriculture of the smaller watersheds above the downstream engineering works. They slow runoff and stabilize sources of sediment in upstream channels.

We are doing these things now just as rapidly as our facilities permit. They represent water-control operations over and above what is ordinarily done through the farm-land conservation job.

(3) *Downstream engineering* for flood control. This comprises the work done on the major waterways to control runoff after it has reached the main stream. It alleviates urban damages and damage to agriculture in the flood plains lower down the major rivers. This major engineering is the responsibility of the Corps of Engineers.

There you have, as we understand it, a coordinated approach to flood prevention and control—a program that protects the farmer or rancher of the uplands as well as of the lowlands, while protecting the cities, too.

Congress has so far authorized watershed programs, including land treatment and upstream engineering, on 11 watersheds in different parts of the country. Many of you no doubt are acquainted with the work under way on the Little Sioux watershed of northwestern Iowa, and the Washita River of Oklahoma. We are carrying out the works of improvement in these two flood-control projects —as in the other nine—primarily through the farmers' soil conservation districts. In all instances our work is coordinated with the authorized work of the Army Engineers farther downstream.

We need go no farther than the city limits of Lincoln—into the Salt-Wahoo watershed—to find what is to my mind a splendid example of the coordinated watershed approach to flood control. Here is a striking illustration of effective community cooperation, including the Salt-Wahoo Watershed Association, which is made up of city people and farmers in soil conservation districts; the Soil Conservation Service; the Army Engineers; and other local, State, and Federal agencies.

Joint studies of this watershed are being made now by our Service and the Army Engineers under authority of the Flood Control Act of 1936. We hope that this study will lead to authorization of a coordinated program for flood control in this area similar to that already authorized in the 11 other watersheds mentioned. I think the soundness of this cooperative approach was well stated in the progress report on the joint watershed survey made by the Army Engineers and Soil Conservation Service. The report pointed out that the two agencies had one objective in this study—that is, to prepare an over-all plan for the entire watershed which, quoting from the report, "will represent from the standpoint of both agencies the best plan for the basin as a whole which is practicable within the limits of economic feasibility, and one which both agencies can recommend and support without reservation."

"Both agencies feel," the report added, "that this objective can best be realized by a joint study which will produce a single plan mutually developed by both agencies rather than a compromise between two individual plans developed by the two agencies acting independently."

The Salt-Wahoo undertaking also illustrates the importance and effectiveness of local group action

in watershed planning and development. Here, as elsewhere, the local soil conservation districts are taking an important part in the permanent watershed program. As the principal organization through which soil and water conservation measures are being applied to the land by individual farmers the country over, it is only logical that these districts also should be called on to serve directly in such flood-control activities in the public interest.

By the same token, the Salt-Wahoo situation shows why there is a place for an advisory group, committee, or association like the Salt-Wahoo Watershed Association, which brings together the interests of farmers and city people. In other words, for a watershed-development program to operate successfully—in Nebraska, in Kansas, or anywhere else—the basic responsibility for that program must involve the people residing in the watershed. That means there must be a local responsible organization such as a soil conservation district, watershed association, or flood-control district, which is representative of all the interests in the watershed and which can act to coordinate the activities and services of all agencies and interests to formulate the necessary broad, flexible program for watershed development and protection.

We have found that the most efficient way of carrying the soil and water conservation job beyond the planning stage anywhere is through coordinated group action of the landowners and operators—with technical and other assistance from other sources. Group action is especially effective, and necessary, in dealing with problems of watershed extent. Soil conservation districts themselves, of course, are basically group-action devices; and their efficiency and success in this direction have been proved by their rapid organization and growth. In only 14 years, approximately 2,350 such districts have been formed in the 48 States, Alaska, Hawaii, Puerto Rico, and the Virgin Islands. They now include more than four-fifths of the farms and ranches in the United States and three-fourths of the country's farm land. Fortunately, the area you editors represent is largely within soil conservation districts. Nebraska, for example, is one of 10 States completely covered by soil conservation districts. Kansas is not far behind with more than 99 percent of its area in districts; while Iowa is 95½ percent covered. If your county doesn't yet have a district, I recommend that you urge the local people to organize one.

High ridges of flood-deposited soil material, scraped off Highway 24 in Douglas County; considerable floodwater was still trapped.

Let me emphasize, however, that planning and application of the watershed program requires special technical skills. Downstream, as you know, the highest order of engineering skill is necessary for building big dams, main-channel stabilization works, and so on. Also, in the uplands technical know-how is required to plan and apply sound land treatment and upstream engineering measures. Such plans must be based on painstaking research and on wide practical experience. They must take into account the principles of hydrology, engineering, agronomy, land science, forestry, biology, and other related fields. Under varying conditions of climate, topography, and drainage, the wrong thing done, or the right thing left undone, on any part of a farm can do serious injury.

In no event can this watershed planning and treatment be accomplished overnight by some magic formula, although it takes heavy rains and excessive runoff only a few days, or even hours, to do irreparable damage to watershed land and property. Our conservation land-treatment and upstream-engineering activities are based, in the first place, on detailed land-capability surveys. They show, acre by acre, the needs and capabilities of the land in relation to combinations of such factors as soil, slope, rainfall, erosion, and so on. Our watershed plans involve the location of sites for small floodwater retarding structures, water-disposal systems, gully-control structures, streambank stabilization, and other upstream-engineering measures.

Our Soil Conservation Service technicians work out on the land cooperatively with farmers, covering entire farms, acre by acre, and field by field. We cannot depend on windshield surveys and office

This terraced slope, about 6 miles east of Richmond, Kans., held its own against the wrath of the Osage River flood. There was terrific erosion in the uplands where the land was not under the protection of soil conservation.

planning in doing a job of the complexity and magnitude of safeguarding the farm lands of the Nation. Nor can we have a ready-made plan including a fixed set of practices to slap on any farm or watershed. Land, and the behavior of the water that falls on the land, differs from watershed to watershed, from farm to farm, and from acre to acre. So every watershed and each parcel of land must be dealt with individually.

That, briefly, is how we go about the treatment of agricultural land for effective soil conservation and flood control. We have developed a unique combination of soil conservation, engineering, and vegetative practices designed to dispose of surplus water safely while making the best practical use of the water that otherwise would be wasted. For the first time in history, we are going into the small watersheds to do everything possible to provide relief from recurring flood damages.

Splendid examples of the effectiveness of tributary stream flood control can be cited from the experience of the Soil Conservation Service.

On May 16, this year, Sandstone Creek with a watershed of 65,000 acres, southeast of Cheyenne, Okla., had 4½ inches of rainfall. The watershed had been treated for soil conservation and flood control. The runoff water did not even come up to the draw-down pipes in the retarding dams. None of the permanent pools were filled. Sandstone Creek, which had been noted for its flooding, contributed practically no flow to the Washita River, while other similar creeks of the locality were flooding and doing great damage.

Farther west, near Clinton, during the same wet period, the Barnitz Creek watershed received about 13 inches of rain within 24 hours. Within its watershed of 4,000 acres four detention structures had been built and the usual surface treatment of terracing, regrassing, contouring, and the like had been completed. The creek stayed within its banks while similar neighboring creeks did great damage with this same precipitation.

Rates of silting have been measured two or three times in some reservoirs—first, before any conservation work was done on their watersheds and again after a substantial part of the needed conservation measures had been applied. Treatment of about 30 percent of the watershed resulted in a 24-percent reduction in the silting rate of the municipal reservoir at High Point, N. C.

In contrast, it was found that more intensive use of land for row crops and lack of conservation measures caused an increase of 20 percent in the silting rate of the water-supply reservoir at Decatur, Ill.

In conclusion, let me assure you that with whatever resources we are provided the Soil Conservation Service will continue to work toward sound soil conservation, wise land use, and protection of the Nation's water resources as well as its land. We will do this in cooperation with local, State, and Federal agencies, or with any other organizations and groups which have like objectives. In working toward the permanent solution of our water problems, the Service will continue to give full consideration to all beneficial water uses, including those for recreation and wildlife. Also, the Service will continue to encourage conservation districts and other conservation organizations to use, to the fullest extent practicable, all available assistance from public and private sources.

Our men throughout the field are acquainted with the principles I have mentioned and I am sure you may count on their living up to them to the fullest possible extent. We will actively cooperate with soil conservation districts and other similar groups. This, together with the positive support of agencies and community leaders like those represented here, who are in a position to help, will expedite the conservation program throughout the country.

We have the knowledge of how to do the job; the conservation tools have been perfected and tested; we have an organization equipped not only with the necessary technical skills, but with the knowledge and understanding to work with local people —individual farmers, community groups, organized districts and associations, city people, and industries as well. As a Nation we have no excuse for not doing the job of conserving our basic soil and water resources; indeed we dare not shirk it, because our individual and national security, peace, and prosperity depend on it.

Edge of 3-foot sand deposit on farm of F. V. Lewis, several miles northwest of Lawrence. This stretch, at depths of 6 to 36 inches, covered about 200 acres on this and four adjoining farms. It is clean, water-assorted sand of low fertility. Some of the land can be improved by plowing up the darker-colored, rich, alluvial material and mixing it with the covering sand. Some of the thicker deposits of sand may need to be dumped into nearby depressions.

Harvest this year will be zero from this field, which normally produces 80 to 100 bushels of corn per acre. It is near Lawrence, Kans.

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